Third United Nations International Conference on the Peaceful Uses of Atomic Energy

A/CONF.28/A/718
BYELORUSSIAN SSR
February 1964
Original: RUSSIAN

Confidential until official release during Conference

Abstract

PHYSICAL CHARACTERISTICS OF THE POOL-TYPE RESEARCH REACTOR IRT-2000 WITH TEST LOOP

A.K. Krasin, V.A. Naumov and I.A. Savushkin
Heat and Mass Transfer Institute of the BSSR Academy of Sciences

The setting of an experimental loop channel inside the core of a research reactor with a high specific power and intensive thermal neutron flux is of interest for performing various experimental works requiring intensive neutron and γ-fluxes as the test conditions.

In the very core of the reactor IRT-2000 with a power of 1700 kW thermal neutron fluxes attain the magnitude of $3 \cdot 10^{13}$ neut/cm^{2}s neutron fluxes with energy over 0.2 eV., the magnitude of $6 \cdot 10^{13}$ neut/cm^{2}s and energy fluxes of γ-radiation, the magnitude of $1 \cdot 10^{14}$ MeV/cm^{2}s, and the rate of γ-dose becomes $1 \cdot 10^{8}$ rad/h.

Such a relatively high degree of radiation allows the experiments on irradiation and on testing checking the radiation resistance of materials as well as various loop experiments to be carried out. Physical characteristics of the water-moderated, water-cooled reactor IRT-2000 with a loop channel in the centre of the core were investigated on the electronic digital computer "Ural-1" of the Institute of Mathematics and Computing Engineering of the BSSR Academy of Sciences.

It is found that the internal reflector around the testing loop channel allows to considerably intensify the thermal neutron flux in the channel region and thus to increase experimental possibilities of IRT-2000.

Beryllium oxide, graphite, water and operating cassettes are considered as the material of the internal reflector. The data are given on the critical mass, reactivity storage, as well as on the fluxes of thermal-moderated and fast neutrons for the mentioned materials of the internal reflector and a number of compositions of the core.

Translation provided by courtesy of the submitting Government

The calculated minimum critical mass of the reactor without a channel with a graphite external reflector, equal to 2520gr.U^{235}, differs from the measured one by 2 per cent.

The minimum critical mass of the reactor with a loop channel, containing more than 3.3 kg. of stainless steel and equal to 3800 gr. of U^{235} is attained in the presence of BeO as an internal reflector.

The maximum reactivity storage and maximum reactor life with a channel are to be observed in the case when operating cassettes are used as an internal reflector.

It is shown in the work that the critical masses of a water-moderated, water-cooled reactor with a loop channel in the centre of the core can be satisfactorily described in the limit of 3-group method, using only the data on neutron microscopic cross-sections and fission neutron age in water.

Multigroup constants are obtained according to the effects of self-shielding of U^{235} and U^{238} resonances and neutron leakage through the gas channel in the core and reflector.

Considerable influence of these effects on the critical mass of a thermal reactor is revealed.

The calculation results on the critical masses and neutron-flux distributions in the core with a channel were compared with the experimental data. This comparison showed a good agreement between the theoretical and experimental results.